
MultiModem®

Wireless Modems
EDGE, GPRS, CDMA
with GPS Functionality



MTCBA-E-GP
MTCBA-G-GP-Fx
MTCBA-C-GP-Nx

User Guide

User Guide

MultiModem® Wireless EDGE, GPRS, and CDMA Modems with GPS Functionality
MTCBA-E-GP, MTCBA-G-GP-Fx, MTCBA-C-GP-Nx
S000376A, Revision A

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Chapter 1 – Introduction and Product Description

This User Guide describes the MultiModem® Wireless EDGE, GPRS, and CDMA modems with GPS functionality. Your product choice depends on the technology (cellular network) available to you.

Product	Your Cellular Network	Interface
MTCBA-C-GP-Nx	CDMA	GPS
MTCBA-E-GP	EDGE	GPS
MTCBA-G-GP-Fx	GPRS	GPS

GPS Interface

The MultiModem EDGE, GPRS, or CDMA wireless modem with GPS incorporates an internal Trimble® Lassen® iQ GPS module providing 12-channel GPS functionality. It delivers complete position, velocity, and time (PVT) solutions making it ideal for real-time vehicle tracking, navigation, and fleet management applications.

The GPS functionality supports four of the most popular protocols: NMEA 0183, DGPS (RTCM), TSIP (Trimble Standard Interface Protocol), and TAIP (Trimble ASCII Interface Protocol) and provides dual sensitivity modes allowing it to automatically switch to higher sensitivity when satellite signals are weak.

The MultiModem EDGE, GPRS, or CDMA wireless modem with GPS utilizes an RS-232 interface. The GPS information is received on a secondary serial port and can be used for in-vehicle navigation. In addition, the data can be sent through the wireless modem to a central, real-time tracking server via SMS or GPRS.

The MultiModem EDGE, GPRS, or CDMA wireless modem provides flexibility to allow third party GPS applications and Application Service Providers (ASPs) the ability to customize their software to work with the wireless modem hardware.

MultiModem EDGE

The MultiModem® EDGE wireless modem delivers some of the fastest cellular wireless data speeds utilizing EDGE technology. It allows users to connect to the Internet and send and receive data up to three times faster than possible with an ordinary GSM/GPRS network making it ideal for highly data-intensive multimedia applications. The MultiModem EDGE wireless modem is equipped with quad-band GSM, which means it can be used worldwide on all existing GSM networks.

AT Commands

The MultiModem EDGE wireless modem is configured using the EDGE AT Commands. These commands are documented in the Reference Guide for the MultiModem Wireless EDGE Modems, document number S000371x located on the MultiModem CD included in your ship kit.

MultiModem GPRS

The MultiModem® GPRS wireless modem offers standards-based multi-band GSM/GPRS Class 10 performance. It supports GSM circuit-switched cellular data connections, offers SMS features, and includes an embedded TCP/IP protocol stack.

AT Commands

The MultiModem GPRS wireless modem is configured using the GPRS AT Commands. These commands are documented in the Reference Guide for the MultiModem Wireless GPRS Modems, document number S000293x and also the Reference Guide for the GSM IP Commands, document number S000333x located on the MultiModem CD included in your ship kit.

MultiModem CDMA

The MultiModem® CDMA wireless modem offers standards-based multi-band CDMA200 1xRTT performance. It supports CDMA IS-95A and IS-95B circuit-switched cellular data connections and offers SMS services.

AT Commands

The MultiModem CDMA wireless modem is configured using the CDMA AT Commands. These commands are documented in the Reference Guide for the MultiModem Wireless CDMA Modems, document number S000294x located on the MultiModem CD included in your ship kit.

Safety Warnings

General Safety

The modem is designed and intended to be used in either fixed or mobile applications. In the “Fixed” application, the device is physically secured at one location and not easily moved to another location. In the “Mobile” application, the device may be regularly moved to different locations.

Caution! Maintain a separation distance of at least 20 cm (8 inches) between the transmitter’s antenna and the body of the user or nearby persons. The modem is not designed for, nor intended to be, used in applications within 20 cm (8 inches) of the body of the user. Such uses are strictly prohibited.

Avoid possible radio frequency (RF) interference by carefully following the safety guidelines below.

- Switch OFF the MultiModem in the vicinity of gasoline or diesel-fuel pumps or before filling a vehicle with fuel.
- Switch OFF the MultiModem in hospitals and any other place where medical equipment may be in use.
- Respect restrictions on the use of radio equipment in fuel depots, chemical plants, or where blasting operations are in progress.
- There may be a hazard associated with the operation of your MultiModem in the vicinity of inadequately protected personal medical devices such as hearing aids and pacemakers. Consult the manufacturers of the medical device to determine if it is adequately protected.
- Operation of the MultiModem in the vicinity of other electronic equipment may cause interference if the equipment is inadequately protected. Observe any warning signs and manufacturers’ recommendations.

Vehicle Safety

- Do not use your MultiModem while driving.
- Respect national regulations on the use of cellular telephones in vehicles. Road safety always comes first.
- If incorrectly installed in a vehicle, the operation of MultiModem telephone could interfere with the correct functioning of vehicle electronics. To avoid such problems, be sure that the installation has been performed by qualified personnel. Verification of the protection of vehicle electronics should be part of the installation.
- The use of an alert device to operate a vehicle’s lights or horn on public roads is not permitted.

Maintenance of the Wireless MultiModem

Your wireless MultiModem is the product of advanced engineering, design, and craftsmanship and should be treated with care. The suggestions below will help you to enjoy this product for many years.

- Do not expose the MultiModem to any extreme environment where the temperature or humidity is high.
- Do not attempt to disassemble the MultiModem. There are no user serviceable parts inside.
- Do not expose the MultiModem to water, rain, or spilled beverages. It is not waterproof.
- Do not abuse your MultiModem by dropping, knocking, or violently shaking it. Rough handling can damage it.
- Do not place the MultiModem alongside computer discs, credit or travel cards, or other magnetic media. The information contained on discs or cards may be affected by the phone.
- The use of accessories not authorized by Multi-Tech or not compliant with Multi-Tech’s accessory specifications may invalidate the warranty of the MultiModem.
- In the unlikely event of a fault in the MultiModem, contact Multi-Tech Technical Support.

Handling Precautions

All devices must be handled with certain precautions to avoid damage due to the accumulation of static charge. Although input protection circuitry has been incorporated into the devices to minimize the effect of this static build up, proper precautions should be taken to avoid exposure to electrostatic discharge during handling and mounting.

Safety Recommendations for Rack Installations

- Ensure proper installation in a closed or multi-unit enclosure by following the recommended installation as defined by the enclosure manufacturer.
- If installing the wireless modem in a closed or multi-unit enclosure, ensure adequate airflow so that the maximum recommended ambient temperature is not exceeded.
- Do not place the device directly on top of other equipment or place other equipment directly on top of this device.
- Ensure that the device is properly connected to earth ground via a grounded power cord. If a power strip is used, ensure that the power strip also provides adequate grounding.
- Ensure that the main supply circuit is capable of handling the load. See the power label on the device for requirements.
- Maximum ambient temperature is 70 degrees Celsius.
- This device should be installed by properly qualified personnel.
- Only connect like circuits; e.g., connect SELV (Secondary Extra Low Voltage) circuits to SELV circuits and TN (Telecommunications Network) circuits to TN circuits.

Ship Kit Contents

The single wireless modem is shipped with the following:

- One MultiModem GPRS/EDGE/CDMA wireless modem with GPS functionality.
- One fused DC power cable.
- Four rubber feet for desktop placement.
- Printed Activation Customer Notices (for Cingular, Sprint, Verizon networks, and general CDMA activation).
- One printed Quick Start Guide.
- One MultiModem CD that provides documentation, two GPS utility programs (iQ Monitor.exe and iQ Chat.exe), and Adobe Acrobat Reader.

The GPS Developer Kit is shipped with the following:

- Three power cords.
- One fused DC power cable.
- One universal power supply.
- Two serial cables.
- Some international kits may have three antennas (two wireless antennas and one GPS antenna).
- Printed Customer Activation Notices (for Cingular, Sprint, Verizon networks, and general CDMA activation).
- One printed Quick Start Guide.
- One MultiModem CD that provides documentation, two GPS utility programs (iQ Monitor.exe and iQ Chat.exe), and Adobe Acrobat Reader.

Wireless Modem Specifications

Features	EDGE Modem	GPRS Modem	CDMA Modem
Performance	EDGE: E-GPRS Class 10 GPRS: Class 12	GPRS Class 10	CDMA2000 1xRTT
Band, Frequency	Quad-band GSM 850/900/1800/1900 MHz	Dual-band 850/1900 or 900/1800 MHz GSM/GPRS	Dual-band 800/1900 MHz CDMA; 800 MHz with R-UIM support
Packet Data	EDGE: E-GPRS Up to 240K bps, Coding scheme MCS 1-9, Mobile station Class B, LLC layer, 4 time slots GPRS: GPRS Class 12, Full PBCCH support, Coding scheme 1- 4, Mobile station Class B	Up to 85.5K bps PBCCH support Coding schemes: CS1 to CS4	Up to 153.6K bps forward and reverse
Circuit-Switched Data	Asynchronous, transparent and non-transparent up to 14.4K bps	Asynchronous, transparent and non-transparent up to 14.4K bps	IS-95A, IS 95B up to 14.4K bps
Fax	Class 1 Group 3	GSM Class 1 and Class 2 Group 3	Class 2.0 Group 3
Short Message Services-SMS	Text & PDU, Point-to-Point MO & MT, cell broadcast	Text & PDU, Point-to-Point, cell broadcast	ASCII Text & UCS-2, Point-to-Point, cell broadcast
Internet Protocols Supported	TCP, UDP, DNS, FTP, SMTP, POP3, HTTP	ARP, Dial-in PPP, DNS Resolve, FTP client, ICMP, IP, IPCP, LCP, POP3 (receive mail), PPP, SMTP (send mail), TCP socket, Telnet client, Telnet server, UDP socket, CHAP, PAP	Dial-in PPP, DNS, FTP, HTTP, ICMP, IP, IPCP, LCP, POP3, PPP, SMTP, SNMP, SNTP, TCP, Telnet, TFTP & UDP
Voice Features	Half rate (HR), Full rate (FR), Enhanced full rate (EFR), Adaptive multi rate (AMR). Basic hands free operation with echo cancellation and noise reduction	NA	NA
Antenna Connectors	RF Antenna: 50 ohm SMA GPS Antenna: 50 ohm SMA	RF Antenna: 50 ohm SMA GPS Antenna: 50 ohm SMA	RF Antenna: 50 ohm SMA GPS Antenna: 50 ohm SMA
SIM Connector	Standard 3V SIM receptacle	Standard 3V SIM receptacle	NA
Interface Connectors	(2) DB-9	(2) DB-9	(2) DB-9
Power Connectors	2.5mm miniature screw	2.5mm miniature screw	2.5mm miniature screw
Voice Connectors	RJ-9 4-pos modjack	NA	NA
Power Requirements	5V to 32 VDC	5V to 32 VDC	5V to 32 VDC
Physical Description	2.8" L x 6.4" W x 1.2" H; 11.5 oz. (7.1 cm x 16.3 cm x 3.0 cm; 326g)	2.8" L x 6.4" W x 1.2" H; 11.5 oz. (7.1 cm x 16.3 cm x 3.0 cm; 326g)	2.8" L x 6.4" W x 1.2" H; 11.5 oz. (7.1 cm x 16.3 cm x 3.0 cm; 326g)
Operating Environment	0° to +50° C	0° to +50° C	0° to +50° C
Humidity	20% to 90% non-condensing	20% to 90% non-condensing	20% to 90% non-condensing
Certifications	CE Mark, R&TTE EMC: FCC Part 2, 15 Class A, 22, 24 EN 55022 EN 55024 Safety: cUL, UL 60950; EN 60950 Network: PTCRB	CE Mark, R&TTE EMC: FCC Part 2, 15 Class A, 22, 24 EN 55022 EN 55024 Safety: cUL, UL 60950; EN 60950 Network: PTCRB	EMC: FCC Part 2, 15 Class A, 22, 24 EN 55022 EN 55024 Safety: cUL, UL 60950; EN 60950 Network: PTCRB
Miscellaneous	AT Command Compatible Desktop or panel mounting Carrier approved Numerous LEDs provide status Embedded TCP/IP stack	AT Command Compatible Desktop or panel mounting Carrier approved Numerous LEDs provide status Embedded TCP/IP stack	AT Command Compatible Desktop or panel mounting Carrier approved Numerous LEDs provide status CDG 1 and 2 network certified CDMA IS-95A, IS-95B backwards compatible
Warranty	Two years	Two years	Two years

GPS Specifications

Key Features

- 12-channel simultaneous operation
- Dual sensitivity modes with automatic switching
- Aided GPS through TSIP
- Antenna open and short circuit detection and protection
- Supports NMEA 0183, TSIP, and TAIP, DGPS protocols
- DGPS capable

Performance

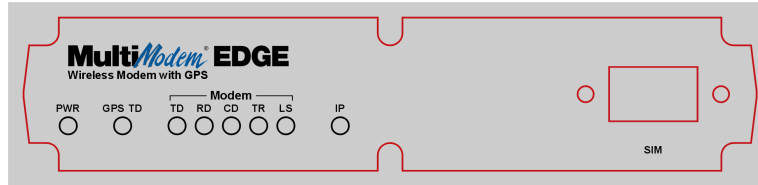
General	L1 frequency (1575.42 MHz), C/A code (Standard Positioning Service), 12-channel, continuous tracking receiver
Update Rate	TSIP @ 1 Hz; NMEA @ 1 Hz; TAIP @ 1Hz
Accuracy	Horizontal: <5 meters (50%), <8 meters (90%) Altitude: <10 meters (50%), <16 meters (90%) Velocity: 0.06 m/sec. PPS (static): ± 50 nanoseconds
Acquisition	(Autonomous Operation in Standard Sensitivity Mode) Reacquisition: <2 sec. (90%) Hot Start: <10 sec. (50%), <13 sec. (90%) Warm Start: <38 sec. (50%), <42 sec. (90%) Cold Start: <50 sec. (50%), <84 sec. (90%) (Cold Start requires no initialization. Warm Start implies that the last position, time, and almanac are saved by backup power. Hot start implies ephemeris also saved. Optional (COCOM) Limits Altitude: 18,000 m Velocity: 515 m/s Either limit may be exceeded, but not both.

Interface

PPS	3.3 V CMOS-compatible TTL-level pulse Once per second
Protocols	TSIP, TAIP, NMEA 0183 v3.0, RTCM SC-104
NMEA	GGA, VTG, GLL, ZDA, GSA, GSV and RMC Messages selectable by TSIP command; selection stored in flash memory.

The Front Panel

The MultiModem wireless **EDGE** modem with **GPS** functionality has 8 LEDs, 5 of which are modem LEDs, and a SIM card.



The MultiModem wireless **GPRS** modem with **GPS** functionality has the same LEDs and SIM card as the EDGE modem.



The MultiModem wireless **CDMA** modem with **GPS** functionality has the same LEDs as the EDGE and GPRS modem, but it does not, however, have a SIM card.



LEDs

PWR POWER.

GPS GPS. Blinks to show GPS is active.

IP IP FUNCTION. This LED blinks when the IP function of the modem is operating normally. It shows a steady light when powering-up, initializing, or flashing the firmware.

Modem LEDs

TD TRANSMIT DATA. This LED blinks when the modem is transmitting data to your wireless carrier.

RD RECEIVE DATA. This LED blinks when the modem is receiving data from your wireless carrier.

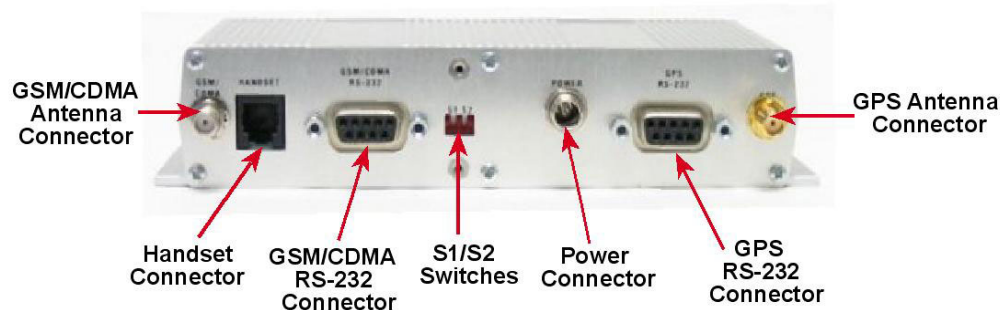
CD CARRIER DETECT. This LED lights when the modem detects a valid carrier signal from a wireless carrier.
TR (DATA) TERMINAL READY. This LED lights when the modem is trying to establish a wireless connection.

LS LINK STATUS. This LED blinks when there is a valid wireless signal. When it is on or off, the wireless strength is low.

Chapter 2 – Setup and Configuration

Back Panel of the MultiModem with GPS

The back panel view is included to help you understand the MultiModem setup.



MultiModem with GPS Interface Back Panel

S1/S2 Switches

Note: The switches as shown in the diagram above are located behind a cover plate that can be removed when you need to change the switch settings.

S1: **Down** puts the MultiModem in reset state.

Up runs the MultiModem properly.

Toggle the S1 switch down and back up to reset the MultiModem.

S2: **Up** keeps the GPS data signals separate from the wireless modem.

Down allows GPS data from Port 1 to flow to the wireless modem's **data in** signal.

Configuring the Wireless Modem Side of the MultiModem

1. Hardware Setup

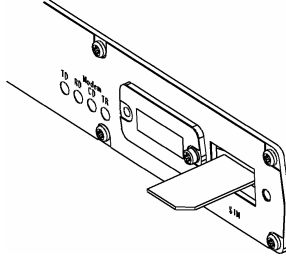
1. Using an RS-232 cable, connect a workstation to the GSM/CDMA connector on the MultiModem.
2. Attach both antennas. The GPS antenna is a 50 ohm SMA antenna. The GSM/CDMA antenna is a standard SMA antenna.
3. Switches S1 and S2 should be in the default positions – both **up**.
4. Plug one end of the power cord into the MultiModem and the other end into a live power outlet. The **PWR** LED lights up.

Warning: Do not connect your wireless modem directly to a vehicle's battery for your power source. Doing so may cause power spikes. If you wish to use the battery as a power source, add a filtering device to the DC input.

2. SIM Card for GPRS or EDGE

The wireless modem requires the power supply connection to begin operation. It also requires a SIM card (Subscriber Identity Module) to operate on a GPRS or EDGE network. To install the SIM card:

1. Use a small screwdriver to remove the screw closest to the outside edge of the modem. Then swing the loosened SIM slot cover up and over to the left.
2. Insert the SIM card into the SIM card slot. The following graphic illustrates the correct SIM card orientation.



SIM AT Commands

SIM Commands for GPRS

SIM commands are included in the **GPRS AT Commands Reference Guide**.

SIM Commands for EDGE

SIM commands are covered in a separate guide entitled **SIM Application Toolkit – AT Commands Reference Guide**.

3. Establish a Wireless Account

Obtain a wireless account through a Wireless Service Provider. This will allow you to use the service provider's network; for example, Cingular, Sprint, and Verizon.

Cingular and Sprint: Contact Multi-Tech, a certified national activation agent for Cingular and Sprint to set up one of these accounts.

Verizon and Others: For Verizon and other accounts, contact their activation agents directly.

Activations Instructions: See the Cingular, Sprint, Verizon, and general Customer Activation Customer Notices included with your modem for a list of the information you must give to the activation agent. You will receive, depending upon your provider, one or two phone numbers and a service programming code or lock code. Write these numbers down as you will have to use them to configure the wireless modem.

If you have any questions or want to set up your account, contact Multi-Tech Systems, Inc. at:
800-972-2439 or 763-717-5863.

4. Establish Internet Access

Internet Access Using:

- **GSM with GPRS**
- **CDMA 1x Data**

A single DUN number is generally used by all of a wireless provider's subscribers throughout its area of coverage – regional, nationwide, continental, etc. Rather than being a literal phone directory number, as in conventional DUN, this is a code that gives the modem Internet access.

Internet Access Using:

- **GSM without GPRS**
- **CDMA Point-to-Point Data**

A circuit-switched data connection is used. Use the dial-up-network (DUN) to make a conventional V.32 modem connection to any terminating modem at the other end. The phone number specified in the DUN can be one supplied by the wireless service provider or another phone number related to a different dialup modem service (e.g., a dialup modem service phone number from any commercial or private dialup network).

5. Login Using TTY

- Use TTY to configure your IP module for the first time. Configure the host serial port using the defaults listed below:
 Baud: 115.2K
 Data: 8
 Parity: N
 Stop: 1
 Flow-Control: None
- Press the Enter key three times to get to the Login prompt.
- At the Login prompt, type *admin*.
- At the Password prompt, type *admin*.
- **Important:** User name and password are case sensitive. They must be typed in lowercase letters.
- Then type **dialout serial s1** to start a dialout session. **Dialout serial s1** is used to initiate a dialout session to the modem. You can now enter AT commands to test your modem.

6. Using AT Commands to Test Your Modem

1. Check the signal quality.

This command determines the received signal strength indication (<rss>)

- Type AT+CSQ
 Modem responds with the received signal strength (<rss>).
 Response 0 means -113 dBm or less
 Response 1 means -111 dBm
 Response 2 to 30 means -109 to -53 dBm
 Response 31 means -51 dBm or greater
 Response 99 means not known or detectable

2. Check the identity of the modem.

Use this command: ATI (*AT* is followed by the capital letter *i*).

- Type ATI0 (The command ends in a zero).
 Manufacturing data displays: *Wavecom Modem 800 1900*
- Type ATI3
 Software version displays. Ex: *S/W VER: xxxxx*
- Type ATI6
 Capability data displays. Ex: *+CGSM, +CIS707, ...*

3. Check the network registration and roaming status.

- Type AT+CREG?
 The modem will respond in one of the following ways:
 +CREG: 0,0 (this tells you the modem is not registered on any network)
 +CREG: 0,1 (this tells you the modem is registered on the home network)
 +CREG: 0,5 (this tells you the modem is registered on a network but it is roaming)

Configuring the GPS Side of the MultiModem

1. Port Configuration

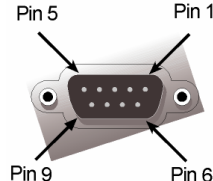
The GPS receiver module has two I/O ports. The table below provides the default protocols and port configurations for the receiver, as delivered from the factory. TSIP IN/OUT is the default protocol on Port 1 and RTCM-IN and NMEA-OUT is the default protocol on Port 2.

Default Protocols and Port Configurations

Port	Input Protocol	Default Setup	Output Language	Default Setup
1	TSIP	Baud Rate: 9600 Data Bits: 8 Parity: Odd Stop Bits: 1 No Flow Control	TSIP	Baud Rate: 9600 Data Bits: 8 Parity: Odd Stop Bits: 1 No Flow Control
2	RTCM	Baud Rate: 4800 Data Bits: 8 Parity: None Stop Bits: 1 No Flow Control	NMEA	Baud Rate: 4800 Data Bits: 8 Parity: None Stop Bits: 1 No Flow Control

The GPS Receiver can also be configured to output TAIP messages. The standard port characteristics for TAIP are:

- Baud Rate: 4800
- Data Bits: 8
- Parity: None
- Stop Bits:1
- No Flow Control

	GPS DB-9: Pin 2 = Port 1 Transmit Data from GPS Pin 3 = Port 1 Receive Data into GPS Pin 6 = Port 2 Transmit Data from GPS Pin 4 = Port 2 Receive Data into GPS Pin 5 = GND
--	---

Any standard serial communications program, such as Windows Hyper-Terminal or PROCOMM, can be used to view the NMEA or TAIP output messages. TSIP is a binary protocol and outputs raw binary serial data that cannot be read when using Windows Terminal or PROCOMM. To view the output of the TSIP protocol in text format, use the **iQ_CHAT** or the **iQ_Monitor** program. These programs are included on the CD-ROM as part of the MultiModem GPS Developer's Kit.

About iQ_Monitor and iQ_Chat Utilities

The **iQ_Monitor.exe** and **iQ_Chat.exe** files plus a Developer's Guide entitled *Developing a Software Interface for the GPS Module in the Multi-Tech MultiModem* are included on the CD as part of the MultiModem Developer's Kit.

iQ_Monitor

iQ_Monitor is used to verify GPS is functioning. The Developer Guide explains how to setup and use this utility.

It is a 32-bit Windows application that interfaces with a TSIP-speaking receiver through the GPS serial port. The program accepts TSIP reports and displays these fields in a window:

Position, Velocity, Time, Receiver Status, and Satellite Track Status.

The program allows you to exercise some basic TSIP commands and can also log a TSIP report in binary format for later translation.

iQ_Chat

iQ_Chat is a 16-bit DOS-based application that interfaces with the GPS receiver through a serial port. It allows you to exercise TSIP commands, configure the GPS receiver for NMEA or TAIP, and view NMEA or TAIP output. It also logs a TSIP report in binary format.

2. Hardware Setup

1. Using an RS-232 cable, connect a workstation to the GPS connector on the MultiModem.
2. Attach both antennas (included in your ship kit). The GPS antenna is a 50 ohm SMA antenna. The GSM/ CDMA antenna is a standard SMA antenna.
3. Plug one end of the power cord into the device and the other end into a live power outlet. The **PWR** LED lights up.

Warning: Do not connect your wireless modem directly to a vehicle's battery for your power source. Doing so may cause power spikes. If you wish to use the battery as a power source, add a filtering device to the DC input.

3. Verify the GPS Connection

The workstation should be running a utility, such as **iQ_Monitor**, to monitor GPS satellite signals. iQ_Monitor is included on the product CD with the MultiModem Developer's Kit.

Chapter 3 – Setup/Configuration Examples

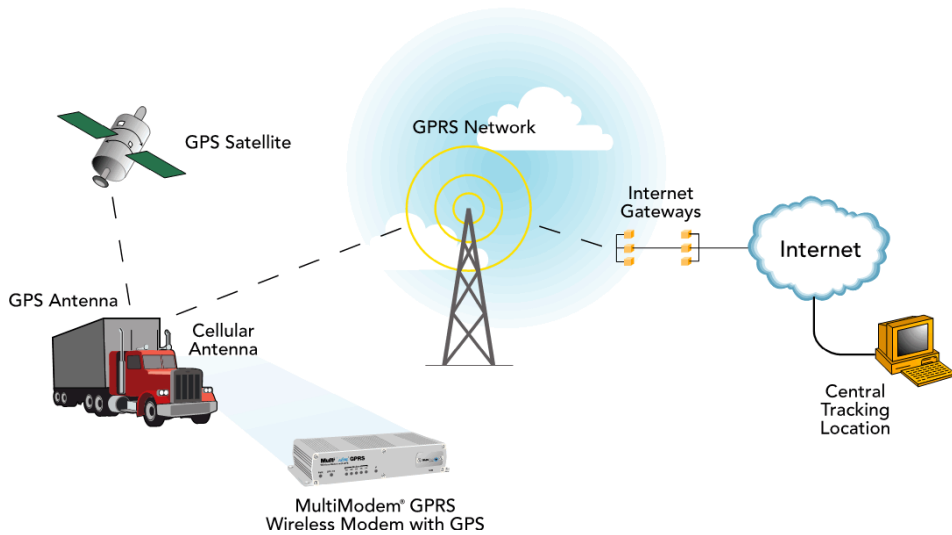
Application Example 1

In this example, the GPS side of the MultiModem is monitoring GPS locations and the wireless modem side of the MultiModem is waiting for incoming data.

A portable workstation, such as a laptop or handheld PC, is connected to this wireless modem to both serial ports – the GSM/CDMA port and the GPS port.

1. Using an RS-232 cable, connect the GPS connector jack to portable PC's serial port.
2. Using an RS-232 cable, connect the GSM/CDMA jack to the PC's other serial port.
3. Attach both antennas (the GPS antenna and the GSM/ CDMA antenna).
4. Set both the S1 and S2 switches **up** (the default). If you have not changed the switches previously, then they will be in the default position. Note that the switches are located behind a cover plate on the connector side of the modem. The cover plate can be removed when you need to change the switch settings.
5. Connect to a power source; for example, to a cigarette outlet on a vehicle.
6. Run your software application that reads GPS data from the GPS serial port. The wireless modem is available to the portable PC for transferring data.
7. Your central tracking station can then retrieve the data wirelessly from your CDMA, GPRS, or EDGE network provider connection.

Application Example 2



This example shows the MultiModem GPRS Wireless Modem with GPS mounted in a truck that can be tracked by a GPS satellite.

This configuration shows a MultiModem located in a vehicle and not connected to a portable PC. The MultiModem in this example simply reads the GPS data as it is sent from GPS satellite, and then it broadcasts the data to your central tracking system by way of your CDMA, GPRS, or EDGE network provider connection.

Note that in this example, you cannot configure the GPS; you can only receive data from port 1 of the GPS.

1. Mount the MultiModem in a vehicle.
2. Attach both antennas (the GPS antenna and the GSM/ CDMA antenna).
3. Verify the S1 switch **up** (the default).
4. Set the S2 switch **down**. This allows data from the GPS port 1 to flow to the wireless modem side of the MultiModem. Then, when you call into this modem from a remote location, the GPS data is displayed on the remotely located workstation's screen. Note that the workstation can be a laptop or a handheld device.
5. Connect to a power source; for example, to a cigarette outlet on a vehicle.
6. Your central tracking station can then retrieve the data wirelessly from your CDMA, GPRS, or EDGE network provider connection.

Chapter 4 – Antennas and Cables

The Antenna

The antenna sub-system and integration in the application is a major issue: Choice of antenna (type, length, performances, thermal resistance, etc.) These elements could affect GSM performances such as sensitivity and emitted power.

EDGE, GSM, and CDMA Antenna

The integrated modem antenna connector is a SMA connector. The SMA connector incorporates a 'Screw-on' action in order to make the connection easier while providing an excellent RF performance. An additional advantage is its small physical size, which is 50% of the standard MCX connector.

This type of connector is suitable for the standard ranges of flexible and semi-rigid cables. The characteristic impedance of the MMCX coaxial connector is 50 ohm. The antenna manufacturer must guarantee that the antenna will be working according to the radio characteristics presented in the table below.

EDGE and GSM Radio Characteristics

	GSM 850	E-GSM 900	GSM 1800	GSM 1900
Frequency RX	869 to 894 MHz	925 to 960 MHz	1805 to 1880 MHz	1930 to 1990 MHz
Frequency TX	824 to 849 MHz	880 to 915 MHz	1710 to 1785 MHz	1850 to 1910 MHz
RF Power Stand	2W at 12.5% duty cycle	2W at 12.5% duty cycle	1W at 12.5% duty cycle	1W at 12.5% duty cycle
Impedance	50 ohms			
VSWR	<2			
Typical Radiated Gain	0 dBi on azimuth plane			

CDMA Radio Characteristics

	CDMA 800	CDMA 1900
Frequency RX	869 to 894 MHz	1930 to 1990 MHz
Frequency TX	824 to 849 MHz	1850 to 1910 MHz
Impedance	50 ohms	
VSWR	<2	
Typical Radiated Gain	0 dBi in at least one direction	

GSM / CDMA Antenna Example

An antenna that meets the requirements for use with this product is included with your purchase.



GPS Antenna Compact Magnetic Mount Antenna

Antenna

Frequency Range	1,575.42+/-1.023MHz
Gain	90°: 3.0dBi min.; 20°: -4.0dBi min. (mounted on the 65mm X 65mm square ground plane)
Polarization	RHCP
Axial Ratio	90°: 4.0dB max.; 10°: 6.0dB max. (mounted on the 65mm X 65mm square ground plane)

LNA

Frequency Range	1,575.42 ±1.023MHz
Gain	28 ±3 dB (-40°C to 85°C)
Noise	1.5dB max. (+25°C ± 5°C) 2.2dB max. (+85°C)
Out of band rejection	$f_0=1,575.42\text{MHz}$ $f_0\pm 20\text{MHz}$ 7dB min. $f_0\pm 30\text{MHz}$ 12dB min. $f_0\pm 50\text{MHz}$ 20dB min. $f_0\pm 100\text{MHz}$ 30dB min.
Output Impedance	50Ω
Output VSWR	2.0max.

Overall Specifications

Frequency Range	1,575.42 ± 1.023MHz
Gain	27 ± 3dBi (+25°C ± 5°C) 27 ± 4dBi (-40°C to 85°C) (mounted on the 65mm x 65mm square ground plane)
Output Impedance	50Ω
VSWR	2.0MAX.
ESD	Antenna surface ± 15KV Connector pin ± 8KV
MTBF	5.13E+6Hr.

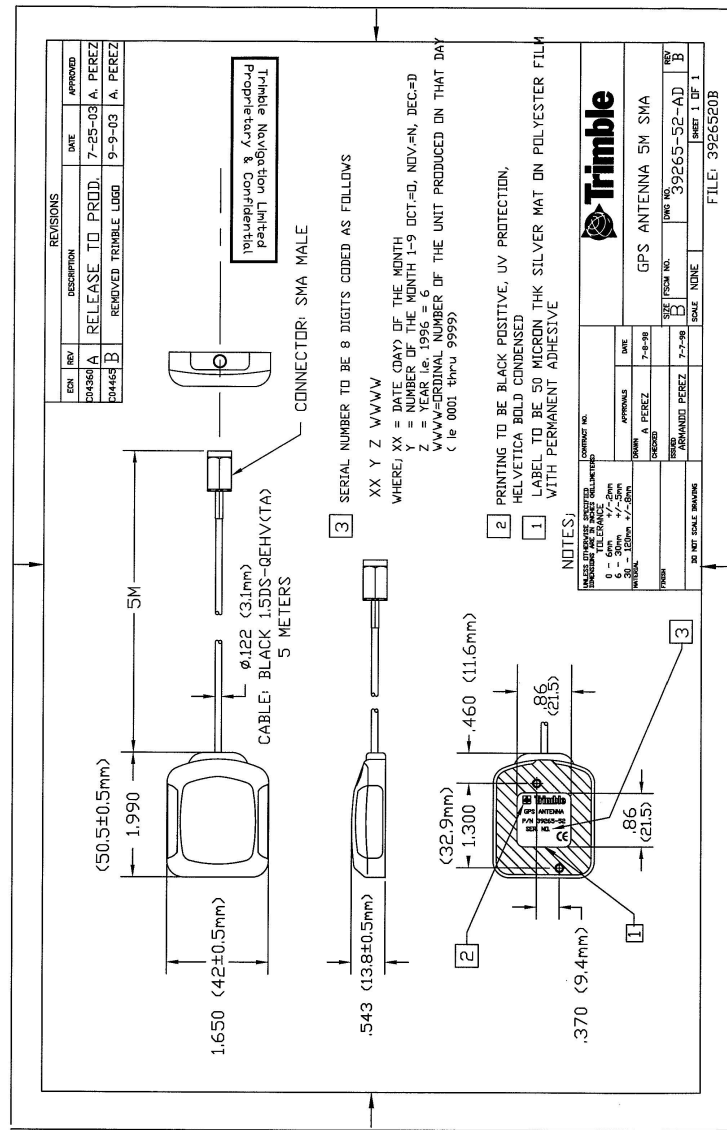
Storage Conditions

Temperature and Humidity	-20°C to 45°C, humidity 80% max. consumption at room temperature
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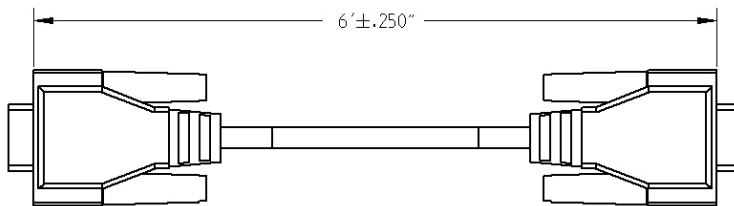
General

Operating Temp.	-40°C to + 85°C
Storage Temp.	-40°C to + 100°C
Relative Humidity	20% to 95%
Input voltage	3.0V ± 0.3V
Power Cons.	15mA max (room temp)
Output connection	MCX (plug)
Cable	1.5DS-QEHV (Shikoku Cable Co.) black: 5m
Weight	20g TYP

Compact Magnetic Mount antenna with 5 m Cable and SMA Connector

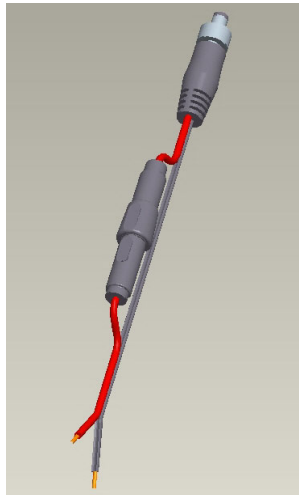


Serial Cable for MultiModem GPS

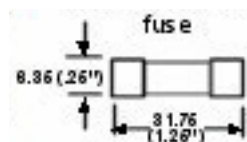


DE-9P		DE-9S
1	—————	1
2	—————	2
3	—————	3
4	—————	4
5	—————	5
6	—————	6
7	—————	7
8	—————	8
9	—————	9

Fused Cable for MultiModem GPS



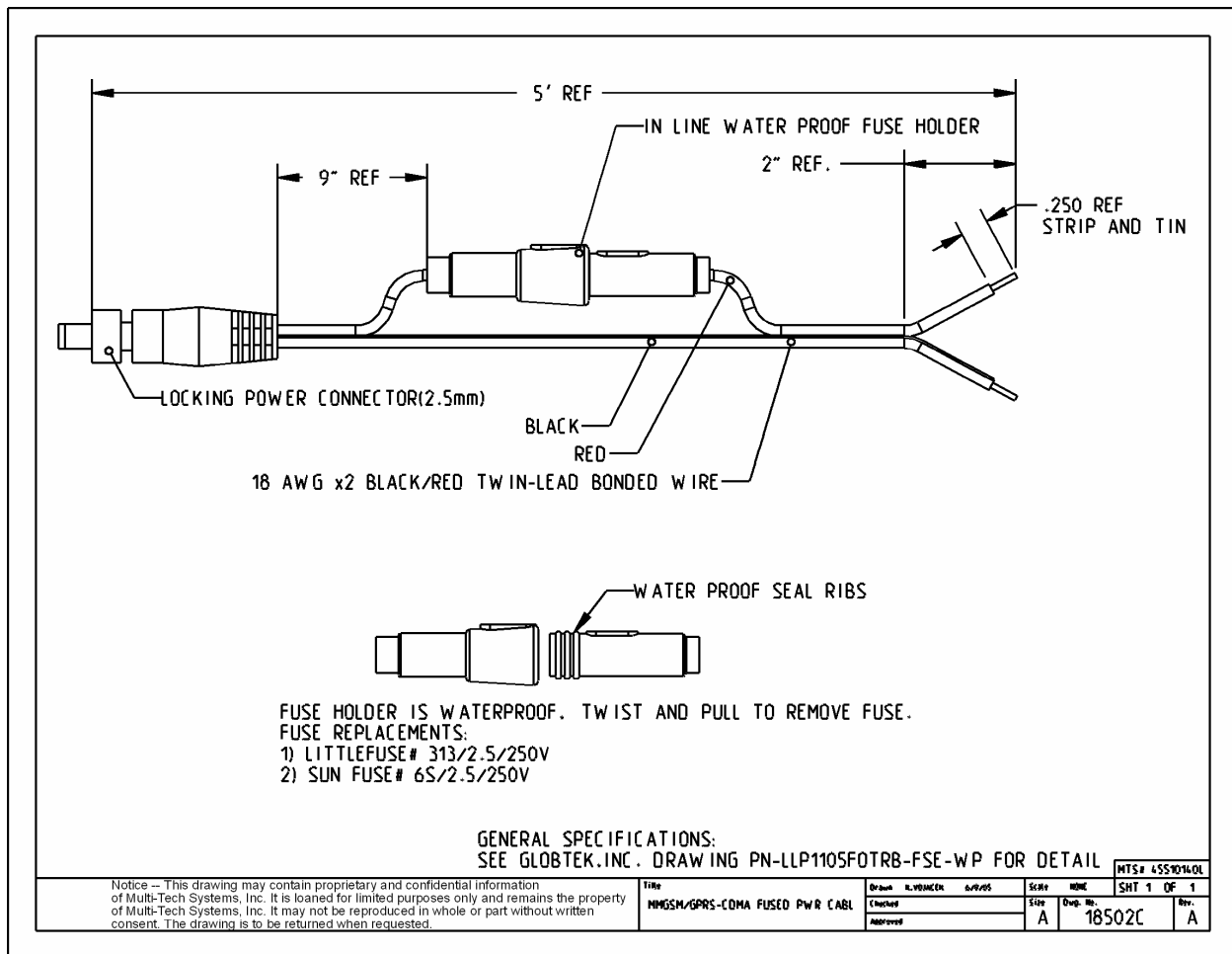
Recommended Replacement Fuses



1. **Manufacturer:** Littelfuse
Part Number: 313 02.5
2. **Manufacturer:** Sun Fuse
Part Number: 6S

Fused Cable Dimensions

Includes: How to Change the Fuse



Appendix A – Multi-Tech Systems, Inc. Warranty and Repair Policies

Multi-Tech Warranty Statement

Multi-Tech Systems, Inc., (hereafter “MTS”) warrants that its products will be free from defects in material or workmanship for a period of two, five, or ten years (depending on model) from date of purchase, or if proof of purchase is not provided, two, five, or ten years (depending on model) from date of shipment.

MTS MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED, AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED.

This warranty does not apply to any products which have been damaged by lightning storms, water, or power surges or which have been neglected, altered, abused, used for a purpose other than the one for which they were manufactured, repaired by Customer or any party without MTS's written authorization, or used in any manner inconsistent with MTS's instructions.

MTS's entire obligation under this warranty shall be limited (at MTS's option) to repair or replacement of any products which prove to be defective within the warranty period or, at MTS's option, issuance of a refund of the purchase price. Defective products must be returned by Customer to MTS's factory — transportation prepaid.

MTS WILL NOT BE LIABLE FOR CONSEQUENTIAL DAMAGES, AND UNDER NO CIRCUMSTANCES WILL ITS LIABILITY EXCEED THE PRICE FOR DEFECTIVE PRODUCTS.

Repair Procedures for U.S. and Canadian Customers

In the event that service is required, products may be shipped, freight prepaid, to our Mounds View, Minnesota factory:

Multi-Tech Systems, Inc.
2205 Woodale Drive
Mounds View, MN 55112
Attn: Repairs, Serial # _____

A Returned Materials Authorization (RMA) is not required. Return shipping charges (surface) will be paid by MTS to destinations in U.S. and Canada.

Please include, inside the shipping box, a description of the problem, a return shipping address (must have street address, not P.O. Box), your telephone number, and if the product is out of warranty, a check or purchase order for repair charges.

For out of warranty repair charges, go to COMPANY/Policies/warranty/

Extended two-year overnight replacement service agreements are available for selected products. Please call MTS customer service at (888) 288-5470 or visit our web site at http://www.multitech.com/PARTNERS/Programs/overnight_replacement/ for details on rates and coverage's.

Please direct your questions regarding technical matters, product configuration, verification that the product is defective, etc., to our Technical Support department at (800) 972-2439 or email support@multitech.com. Please direct your questions regarding repair expediting, receiving, shipping, billing, etc., to our Repair Accounting department at (800) 328-9717 or (763) 717-5631, or email mtsrepair@multitech.com.

Repairs for damages caused by lightning storms, water, power surges, incorrect installation, physical abuse, or user-caused damages are billed on a time-plus-materials basis.

Repair Procedures for International Customers (Outside U.S.A. and Canada)

Your original point of purchase Reseller may offer the quickest and most economical repair option for your Multi-Tech product. You may also contact any Multi-Tech sales office for information about the nearest distributor or other repair service for your Multi-Tech product. The Multi-Tech sales office directory is available at http://www.multitech.com/COMPANY/contact_us/

In the event that factory service is required, products may be shipped, freight prepaid to our Mounds View, Minnesota factory. Recommended international shipment methods are via Federal Express, UPS or DHL courier services, or by airmail parcel post; shipments made by any other method will be refused. Please include, inside the shipping box, a description of the problem, a return shipping address (must have street address, not P.O. Box), your telephone number, and if the product is out of warranty, a check in U.S. dollars drawn on a U.S. bank or your company's purchase order for repair charges. Repaired units shall be shipped freight collect, unless other arrangements are made in advance.

Please direct your questions regarding technical matters, product configuration, verification that the product is defective, etc., to our Technical Support department nearest you or email support@multitech.com. When calling the U.S., please direct your questions regarding repair expediting, receiving, shipping, billing, etc., to our Repair Accounting department at +(763) 717-5631 in the U.S.A., or email mtsrepair@multitech.com.

Repairs for damages caused by lightning storms, water, power surges, incorrect installation, physical abuse, or user-caused damages are billed on a time-plus-materials basis.

Repair Procedures for International Distributors

International distributors should contact their MTS International sales representative for information about the repairs for their Multi-Tech product.

Please direct your questions regarding technical matters, product configuration, verification that the product is defective, etc., to our International Technical Support department at +(763)717-5863. When calling the U.S., please direct your questions regarding repair expediting, receiving, shipping, billing, etc., to our Repair Accounting department at +(763) 717-5631 in the U.S.A. or email mtsrepair@multitech.com.

Repairs for damages caused by lightning storms, water, power surges, incorrect installation, physical abuse, or user-caused damages are billed on a time-plus-materials basis.

Replacement Parts

SupplyNet, Inc. can supply you with replacement power supplies, cables, and connectors for selected Multi-Tech products. You can place an order with SupplyNet via mail, phone, fax, or the Internet at the following addresses:

Mail:	SupplyNet, Inc. 614 Corporate Way Valley Cottage, NY 10989
Phone:	800 826-0279
Fax:	914 267-2420
Email:	info@thesupplynet.com
Internet:	http://www.thesupplynet.com

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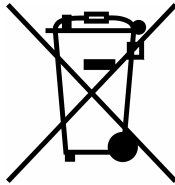
Appendix B – Waste Electrical and Electronic Equipment

Waste Electrical and Electronic Equipment (WEEE)

The WEEE directive places an obligation on EU-based manufacturers, distributors, retailers and importers to take-back electronics products at the end of their useful life. A sister Directive, ROHS (Restriction of Hazardous Substances) complements the WEEE Directive by banning the presence of specific hazardous substances in the products at the design phase. The WEEE Directive covers all Multi-Tech products imported into the EU as of August 13, 2005. EU-based manufacturers, distributors, retailers and importers are obliged to finance the costs of recovery from municipal collection points, reuse, and recycling of specified percentages per the WEEE requirements.

Instructions for Disposal of WEEE by Users in the European Union

The symbol shown below is on the product or on its packaging, which indicates that this product must not be disposed of with other waste. Instead, it is the user's responsibility to dispose of their waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact your local city office, your household waste disposal service or where you purchased the product.



July, 2005

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